John Napier

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John Napier's life

John Napier was born in 1550 in the Tower of Merchiston, near Edinburgh, Scotland. His father, Archibald Napier, was knighted in 1565 and was appointed Master of the Mint in 1582. His mother, Janet Bothwell, was the sister of the Bishop of Orkney. Napier's was an important family in Scotland, and had owned the Merchiston estate since 1430.

Napier was educated at St Salvator's College, graduating in 1563. He was just 13 years old when his mother died and he was sent to St Andrew's University where he studied for two years. This is where he gained his interest in theology. He did not graduate, however, instead leaving to travel around Europe for the next five years. During this time he gained knowledge of mathematics and literature, however it is not known where he studied.

Upon returning to Scotland, Napier devoted himself to his estate and his religion. Napier married his first wife, Elizabeth, in 1572 and they moved to their castle in Gartness in 1574. Together they had a son, Archibald, and a daughter, Jane; however Elizabeth died shortly after Jane was born. Napier later married Agnes Chisholm who bore five sons and five daughters. John Napier died on 4 April 1617 at the age of 67.

Merchiston Tower

Napier's logarithms

Napier's idea in inventing the logarithm was to save mathematicians from having to do large calculations. These days, calculations involving large numbers are done using calculators or computers; however before these were invented, large calculations meant that much time was taken and mistakes were made.

Napier's logarithm was not defined in terms of exponents as our logarithm is today. Instead Napier thought of his logarithm in terms of moving particles, distances and velocities. He considered two lines, AZ of fixed length and $A'Z'$ of infinite length and points X and X' starting at A and A' moving to the right with the same initial velocity. X' has constant velocity and X has a velocity proportional to the distance from X to Z. $A'X'$ is the Napierian logarithm of ZX. In our notation the Napierian logarithm can be defined as

$$\text{Nap.log}\, y = 10^7 \ln\left(\frac{10^7}{y}\right)$$

Napier later worked with Henry Briggs to develop the logarithms that we use today. Together they constructed many tables of logs which have been used widely throughout the world.

Today's logarithms

Logarithms are defined as the inverse of exponents. Just like exponents, logarithms can have any base however the most common bases are ten (since we use a base ten number system) and e (the natural logarithm). The logarithm of a number in base a is defined to be the number that a must be raised to to get that number. For example:

$\log_2 2 = 1$ $\log_3 3 = 1$
$\log_2 4 = 2$ $\log_3 9 = 2$
$\log_2 8 = 3$ $\log_3 27 = 3$

Logarithms make smaller numbers from larger numbers, thus reducing calculations by a fair amount. However, more importantly, logarithms reduce multiplications to additions, divisions to subtractions and powers to multiplications as follows.

$$\log(x.y) = \log(x) + \log(y)$$
$$\log\left(\frac{x}{y}\right) = \log(x) - \log(y)$$
$$\log\left(x^y\right) = y\log(x)$$

Once a solution has been found to the problem the antilog can be found to give the correct answer.

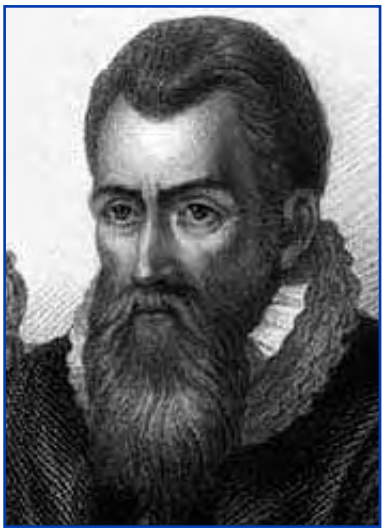
Other works of Napier

Napier was also devoted to the Protestant religion. He considered his most important work to be the *Plaine Discovery of the Whole Revelation of St. John* which was published in 1593. The work was based on the Book of Revelation, in which Napier believed the symbols were mathematical and could be interpreted with logic. The book claimed that the Pope of 1593 was the Antichrist and that the world would end between 1688 and 1700.

Napier believed that the King of Spain, King Philip, might invade Scotland, and in order to protect his country made many inventions. He is credited with early inventions of the tank, submarine and machine gun, as well as bulletproof clothing. One story goes that he took a flock of sheep to test his machine gun and afterwards swore never to make another gun or reveal how it was made.

Seeing there is nothing that is so troublesome to mathematical practice, nor that doth more molest and hinder calculators, than the multiplications, divisions, square and cubical extractions of great numbers … I began therefore to consider in my mind by what certain and ready art I might remove those hindrances.

John Napier



Influences

Napier's work on logarithms greatly influenced the work that was to be done in the future. The logarithm's ability to simplify calculations meant that Kepler and many others were able to find the relationships and formulas for motion of bodies. In turn, Kepler's laws and observations provided a basis for Newton's theory of gravitation. Laplace commented that the invention of logarithms, 'by shortening the labours, doubled the life of the astronomer'.

It can also be argued that logarithms were the early calculators and computers. Both of these things were invented to aid mathematicians in their calculations, exactly the same idea as the logarithm. Napier invented a primitive form of a calculating machine which is now called Napier's Bones. They consist of a set of rods which can be laid together to find the solutions to multiplications and divisions.

Further reading

http://ebooks.whsmithonline.co.uk/ENCYCLOPEDIA/42/P0005342.htm

http://students.cs.byu.edu/~mdr /biography.htm

http://en.wikipedia.org/wiki/Napier's_bones

http://www.maths.adelaide.edu.au/people/pscott/history

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